Crossing boundaries – competence-based learning for sustainable development in a virtual mobility setting

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ABSTRACT

To contribute effectively to sustainable development, professionals should have the competence to communicate and collaborate across the traditional boundaries of, for example, discipline, nation, or culture. Important ingredients of competence-based learning environments for sustainable development are therefore cross-boundary contexts and group work, with international student mobility as a prerequisite. An alternative to costly physical mobility schemes in higher education is 'virtual mobility', using e-learning environments that allow time and place independent communication and collaboration at low cost. Two successful examples of competence-based learning environments for sustainable development in a virtual mobility setting are presented and their perspectives discussed.

KEYWORDS
sustainable development; competences; higher education; e-learning; virtual mobility

INTRODUCTION

Higher education is currently facing two major challenges. The first challenge concerns the emergence of the knowledge society and the second challenge the widely acknowledged need to achieve sustainable development globally (Bereiter, 2003; UNCED, 1992). To be able to participate in today's knowledge society and contribute to sustainable development successfully, students need to develop attitudes, knowledge and skills which the traditional system of higher education often does not provide. In the knowledge society, professionals should possess integrative competences rather than disciplinary separated knowledge with a limited shelf life. Learning environments in higher education are therefore increasingly geared

towards competence development, with a problem-oriented approach, an authentic context and active, often collaborative knowledge construction as major ingredients. The implications for learning for sustainable development in higher education are that the focus should rather be on identifying competences and developing appropriate learning environments, than on defining the exact type of knowledge students should acquire. In this paper, we propose a set of key competences for sustainable development and argue that a virtual mobility setting, exploiting collaborative e-learning tools, offers an excellent learning environment to develop these competences.

COMPETENCES FOR SUSTAINABLE DEVELOPMENT

The term ‘competences (or: competencies) for sustainable development’ is not yet commonly used. However, in the context of education for sustainable development (ESD), there is extensive literature on what should be taught and learned in terms of knowledge, skills and values (see IAU, 2006). Prominent attention to values stands out in most of the literature, including publications addressing higher education. The underlying idea is that value-education, and – as an outcome of that - a change in attitude is needed to prepare the students for a role as ‘agents of change’, able and willing to transform our current society into a more sustainable version (e.g. UNESCO, 1997; Rowe, 2002). The exact nature of these values and attitudes depends on the ideological point of departure and its perspective on what a sustainable society should look like.

What is strikingly absent in these approaches to ESD, is the notion that there may be a valid diversity in perspectives on sustainable development. This is all the more remarkable as one of the most prominent features of the concept of sustainable development is the many different ways in which it is interpreted. This diversity seems inevitable, given the global scale and complexity of sustainability problems and the many uncertainties that surround them. In a pluralistic approach, one accepts this diversity as valid, i.e. stemming from different, but equivalent value systems that result in different, but internally consistent perspectives on sustainable development. Even if one would reject the equivalence of different value systems and advocate a superior perspective, one should realize that in an open democracy plurality is a fact of life. It is unlikely that nationally or even globally the majority of the population could be converted to a single ‘superior’ perspective through (higher) education. The diversity of perspectives among teachers alone would already be prohibitive. Therefore, instead of ignoring this diversity, we explicitly take it as our point of departure when defining key competences for sustainable development.

The diversity of perspectives can be valued positively for several reasons. The thrust of sustainable development is to prevent as much as possible shifting the burden of

improvements in one domain or for one group to other domains or groups. Taking a diversity of perspectives into account will thus provide a sharper eye to detect such shifts, and may result in more balanced decisions. Multiple perspectives could also enable a richer definition of complex sustainability problems and produce a wider array of potential solutions, which, in the face of uncertainty, enhances the probability to find adequate solutions (Janssen and Osnas, 2005). However, the diversity of perspectives also entails a risk of conflict, political paralysis and a lack of societal support at a time when joint, large-scale measures may be urgently needed (Keulartz, 2005). Such situations are likely to occur, because, despite intentions to prevent unjust shifts of costs, some groups are bound to win (or lose) more than others.

Diversity in perspectives thus creates the need for negotiation and dialogue or social learning, to arrive at richer, more complete definitions of sustainability problems, a wider array of potential solutions, and more balanced, broadly supported measures.

In the context of higher education, we define competences for sustainable development as those combinations of knowledge, skills and attitudes that enable graduates to effectively contribute to transition processes towards a (more) sustainable society, on the basis of their domain-specific expertise and more general academic competences. As outlined above, the ability to deal with a diversity of perspectives is crucial in such transition processes. We therefore argue that the key competence for academic professionals to successfully contribute to sustainable development will be their ability to think, communicate, learn and collaborate across the boundaries that divide these perspectives. We refer to the ability to cross such boundaries as ‘transboundary competence’. This ability is essential as it will be impossible for students to develop a ‘super-perspective’ and become a ‘sustainable development specialist’ with a comprehensive combination of knowledge, skills and values. Rather they will, as graduates, contribute to sustainable development, often in team work, on the basis of their own values, individual talents and specialized expertise. To do that effectively, however, they should be aware of their own limitations, acknowledge the diversity of perspectives, and be able to think across boundaries and build bridges between their own perspective and that of others (Keulartz et al., 2004).

Major boundaries to be crossed when contributing to sustainable development are those between:

- parts or subsystems;
- disciplines;
- science and other societal domains;
- nations or cultures;
- local and global scales;
- short and long-term (time scales);
- conventional and innovative approaches.

Transboundary competence thus comprises the abilities to take a whole systems-oriented, interdisciplinary, participatory or transdisciplinary, international, cross-cultural, cross-scale, future-oriented, and creative approach to sustainability problems. Of course, the degree in which all these abilities will be developed may vary among students and study programs.

COMPETENCE-BASED LEARNING FOR SUSTAINABLE DEVELOPMENT

The concept of competence-based learning has been developed over the past decade and has gained ground as a dominant educational approach in The Netherlands. Its development was a response to the requests of the labour market and the wish of educators to make formal education more meaningful and relevant. The idea is that learning should focus on integrative competences required in professional life, and not on the acquisition of isolated skills and pieces of knowledge. The best way to acquire these competences appears to be in a learning environment that combines actual practice ('learning by doing'), and explicit reflection on what and how to learn from that practice ('learning by reflection') (Könings et al., 2005). 'Learning-by-doing' involves that the learning environment is realistic or authentic in terms of the problems the students have to solve, the tasks they have to perform, and the context of these tasks. 'Learning-by-reflection' requires that students explicitly reflect on their learning goals, activities, results and ways to improve.

Based on these principles, the characteristics of an 'ideal' learning environment for sustainable development, fostering transboundary competences, are defined in Table 1. In a traditional educational setting, such a learning environment with cross-boundary contexts and group work as major ingredients is difficult to realize. It would require a high level of international student mobility to bring students from different disciplinary, national and cultural backgrounds repeatedly together at the same time, at the same place. An alternative to costly physical mobility schemes in higher education is 'virtual mobility', using electronic learning environments. E-learning, or more precise computer-supported collaborative (CSCL) learning environments provide an innovative and almost ideal solution to the problem, as the modern ICT-tools they exploit allow time and place independent communication and group work (Ivens et al., 2002).

In the next sections, two successful examples of competence-based learning environments in a virtual mobility setting are presented and their future perspectives discussed.

Table 1. Characteristics of a competence-based learning environment applied to learning for sustainable development. See for a detailed explanation: De Kraker et al., 2007.

General feature	Application to learning for sustainable development
realistic problems or cases	• ill-structured problem description • multiple scale, multiple domain issues
realistic tasks or roles	• open-ended • active integration of different aspects of problem and knowledge from different domains • thinking and reasoning across diverging scales of time and/or space • stimulating creative solutions • dealing with multiple perspectives on the problem
realistic context	• heterogeneous student groups (multidisciplinary, multi-cultural, international) • open learning environment, interaction with experts, clients or stakeholders from outside university
explicit reflection on task performance and learning	• reflection on quality of products in relation to quality of processes and learning strategies • reflection on processes in heterogeneous groups (negotiation, social learning) • individual reflection complemented by group discussions and organized feedback (preferably also from outside the university)

TWO SUCCESFUL MODELS: VIRTUAL SEMINAR AND VIRTUAL COMPANY

European Virtual Seminar on Sustainable Development

In an academic context, the term ‘seminar’ traditionally refers to a group of students or scholars studying (scientific) problems under the guidance of a teacher or expert. In a ‘virtual seminar’, the communication among the members of the study group and between the students and their teacher is supported by internet-based computer conferencing technology. This means that in principle all communication within a virtual seminar can be time- and place independent.

Inspired by encouraging experiences gained in the Global Seminar on Environment and Sustainable Systems (www.globalseminar.org), the Open University of the Netherlands and the European Copernicus Charter network of universities developed a ‘European Virtual

Seminar on Sustainable Development' (EVS, for details see: Cörvers et al., 2007). Since the pilot project in 2001, the EVS has been organised once a year, and the number of participating institutions has gradually risen (Table 2). At present (2007), the network consists of 20 partner institutions in 13 European countries.

Table 2. Institutions and students participating in the European Virtual Seminar

Year	No. of institutions	No. of countries	No. of student groups	No. of case studies	No. of students enrolled	No. of students passing
2001	9	4	6	3	59	43
2002	11	5	6	4	45	30
2003	15	9	11	5	61	37
2004	18	11	13	5	78	41
2005	12	9	10	5	68	41

The aim of the EVS is to foster an international, multidisciplinary dialogue on sustainable development among students from all over Europe. The EVS confronts students directly with divergent peer views on sustainable development, and their implications for a societal shift towards a more sustainable Europe. These differences in student views depend on differences in the social, economic, political, cultural or environmental contexts in which the students live. The learning process in an EVS differs greatly from that in mainstream education. There are no lectures in an EVS, the students have to work on case studies in international, multidisciplinary groups, the group members cannot organise face-to-face meetings, and all collaboration and social processes depend on communication using modern ICT.

The overall theme of the case studies is sustainable development in Europe. In the EVS, a case study is an open problem description that invites students to seek the best possible solution. Each student group works on one case study. They have to formulate a problem description, write a research proposal, select information from a range of sources and integrate these with current theory to devise the 'best possible' solution to the problem. Their work culminates in a group report, in which they operationalise the main terms in the case study, produce a group definition of sustainable development, integrate the views of the group members (from a range of cultural and disciplinary backgrounds) on the problem, and produce a policy summary for the defined target group (i.e. the stakeholders). The students reflect on their learning process at various points during the seminar and produce both individual and group reflection reports.

The computer conferencing system used for the purpose of the EVS is the Blackboard Learning System. All EVS course materials are accessible via Blackboard. What is more important for the EVS, however, are the tools for communication and interaction. The students

can use electronic discussion boards, e-mail facilities, virtual classrooms and chatrooms, as well as a tool for file exchange between group members. In the educational format, the emphasis is on asynchronous communication using pre-structured group discussion boards between group members (and their tutor). The risk of long delays in communication between students is minimised by the adoption of a clear set of rules.

The organisational model for the EVS is based on a network of higher education institutions sharing expertise and investing staff time and resources. It is a bottom-up approach without formal, top-down institutional arrangements. A core of active and experienced partner institutions is needed in order to sustain the EVS. The success of the EVS proves that a bottom-up approach without any external funding can work, as the network has undergone substantial enlargement since 2001.

Virtual Environmental Consultancy

A 'virtual company' is an educational setting in which learning and work experience have been fully integrated in an electronic learning environment. The learning environment resembles an authentic professional situation. At the Open University of the Netherlands, the virtual company concept was introduced in the late 1990s and has since been developed further and extensively evaluated (Westera and Sloep, 1998; Westera et al., 2000; Bitter-Rijpkema et al., 2003). The most successful version is the Virtual Environmental Consultancy (VEC), which is part of the university's study program in Environmental Sciences (for details, see: Ivens et al., 2007).

The aims of the VEC are two-fold. The first aim is to equip the students with the competence to communicate and collaborate with others in the field of environment and sustainability, such as colleagues from different disciplines, specialists, private and public clients. The second aim is to develop the students' ability and attitude to learn 'life long', as in the fast developing field of environmental issues, professionals have to come up with new solutions to new, complex problems time and again.

The external 'real' world plays an important role in this educational format. To make the learning environment authentic, students have to carry out *real* projects for *real* clients. Typical clients are governmental (local, provincial or state) and non-governmental agencies, public sector institutes and sometimes private sector companies. Projects generally concern questions which are in an early stage of definition, and which can typically be answered by means of desktop studies.

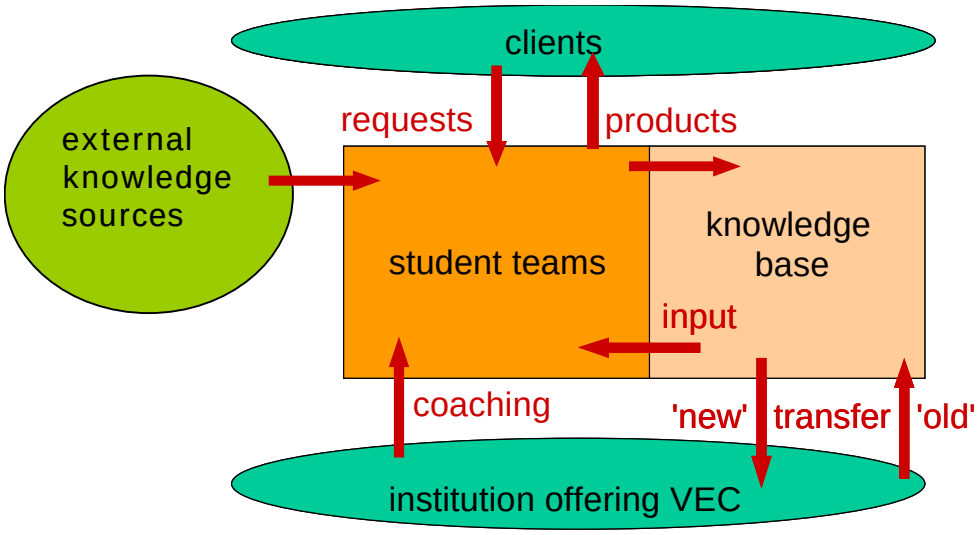

Figure 1. General structure of the Virtual Environmental Consultancy

The general structure of the VEC is presented in figure 1. The core element in this structure is that of student project teams (figure 1), carrying out projects commissioned by clients. They do so using a knowledge base consisting of information already present in the VEC or by using input available from the outside world. The knowledge base initially receives some input from materials available at the institution that offers the module. Further new knowledge is added from the work carried out in the external projects. The institution offering the module provides coaching for the project teams and individual student employees. The results of each project are delivered to the client.

The VEC is not restricted to a fixed location on the premises of the educational institute offering the module, it is located in ‘cyberspace’, i.e. mediated via a computer network. It thus allows for virtual mobility of the Open University’s students, which live geographically dispersed over the Netherlands and Belgium. The web-based office is the heart of the consultancy. Actually, it is not one room but a set of many rooms for project teams and working groups, departments in the virtual consultancy agency (e.g. helpdesk, training centre, knowledge base) and individual rooms for individual portfolios. In this groupware-based environment, the employees can place and share documents, organise discussions and pose questions. It also offers generally accessible files, for instance on project results, fact sheets, a database recording employees’ presence, and so on.

Students are generally enthusiastic about the VEC. They find it a stimulating and productive environment, and particularly appreciate the interaction with the ‘real’ outside world and the feedback on their performance.

CONCLUSION AND FUTURE PERSPECTIVES

Both the European Virtual Seminar (EVS) and the Virtual Environmental Consultancy (VEC) have many of the characteristics of a learning environment for transboundary competence listed in table 1. There is a clear difference in focus, however. The virtual seminar aims to establish a dialogue among students and targets primarily their abilities to think and communicate across boundaries. In EVS this concerns the boundaries between disciplinary and national perspectives. The focus is on arriving at a shared perspective on the problem and possible solutions. The virtual company deals with actual problem solving. Central to this type of learning environment is the ability of the students to collaborate across boundaries. In the VEC, this not only concerns the boundaries between different disciplinary backgrounds within the student teams, but, more importantly, also between a student team and actors from outside the university (clients, professional experts and occasionally stakeholder groups).

A combination of EVS and VEC, with international, highly multidisciplinary student teams working in a transdisciplinary way on complex sustainability problems for real clients and involving multiple stakeholders, would theoretically result in an almost ideal learning environment for sustainable development. However, inclusion of all these elements would make it a tremendously complex learning environment to students and staff. The current formats of EVS and VEC represent about the maximum level of complexity students can cope with. More complexity, in the problems, in the communication between team members, in the interactions with the outside world, would most probably reduce the effectiveness of the learning environment. Clearly, the goal of one single ideal learning environment in which all competences for sustainable development can be developed is far too ambitious. It will be more realistic to try to achieve this at the level of the curriculum, with a variety of specialized learning environments each focussing on the development of a limited set of competences.
A recent development is the introduction of more explicitly cross-cultural aspects in both a virtual seminar and a virtual company learning environment for an international Master Program on Sustainable Development and Management by OUNL and universities participating in the ELAN network (European-Latin American Network for Sustainable Development, www.uni-lueneburg.de/infu/alfa/en/). In a pilot run, a team of Dutch students conducted a consultancy project for the Argentinian provincial government of Mendoza. In this case, the added complexity of the cross-cultural aspects was compensated by the more homogeneous composition of the student team. Another recent development is the upscaling of the virtual seminar approach of the EVS to a Virtual Campus for a Sustainable Europe by a consortium of European universities (eacea.ec.europa.eu/static/en/elearning/compendia2006/documents/ vcse.pdf). The objective is to promote sustainable development by virtual mobility of students within the European Union.

It appears that ‘virtual mobility’ approaches to learning for sustainable development, as presented in this paper, are not only preferable on educational grounds. The required technology for time and place independent communication and collaboration is currently widely available, inexpensive and yet powerful. It is thus within reach of institutions of higher education across the globe and this low-cost technology enables a ‘bottom-up’ organisational model, which can be easily expanded to include more partners without the need for external funding. Moreover, the flexible nature of the ‘virtual mobility’ approaches makes them relatively easy to fit in with existing modes of curricular organization. We expect therefore a widespread adoption and, of course, adaptation of these approaches in learning for sustainable development.

REFERENCES

Bereiter, C (2003). 21st Century skills – challenge or fallacy? In: E. de Corte et al. (Eds.), Powerful learning environments: unravelling basic components and dimensions. Elsevier Science, Oxford.

Bitter-Rijpkema, ME, Sloep, PB and Jansen, D (2003). Learning to change: the virtual business learning approach to professional workplace learning. Educational Technology & Society. 6(1), 18-25.

Cörvers et al., J Leinders and R van Dam-Mieras (2007). Virtual seminars – or how to foster an international, multidisciplinary dialogue on sustainable development. In: J de Kraker et al. (Eds.), Crossing boundaries – Innovative learning for sustainable development in higher education. United Nations University Press, forthcoming.

De Kraker, J, A Lansu and R van Dam-Mieras (2007). Competences and competence-based learning for sustainable development. In: J de Kraker et al. (Eds.), Crossing boundaries – Innovative learning for sustainable development in higher education. United Nations University Press, forthcoming.

IAU - International Association of Universities (2006), Selected bibliography on education and sustainable development. Available at: http://www.unesco.org/iau/sd/sd_bibliography.html

Ivens, WPMF, van Dam-Mieras, MCE, Kreijns, CJ, Cörvers, RJM and Leinders JJM (2002). Use of virtual communities for education in sustainable development. In: Proceedings Conference Engineering Education in Sustainable Development, Delft, 24-25 October 2002, p. 602–610.

Ivens, W, J de Kraker, M Bitter-Rijpkema and A Lansu (2007). Collaborative learning in an authentic context: a virtual consultancy. In: J de Kraker et al. (Eds.), Crossing boundaries – Innovative learning for sustainable development in higher education. United Nations University Press, forthcoming.

Janssen, MA and EE Osnas (2005). Adaptive capacity of Social-Ecological Systems: Lessons from immune systems. EcoHealth 2: 1–10.

Keulartz, FWJ (2005). Boundary-Work - The tension between diversity and sustainability Paper presented at the conference on Sustainability at Universities in the Czech Republic: What are Possibilities, September 2005.

Könings, KD, Brand-Gruwel, S, van Merriënboer, JJG. (2005). Towards more powerful learning environments through combining the perspectives of designers, teachers and students. British Journal of Educational Psychology 75: 645-660.

Rowe, D (2002). Environmental literacy and sustainability as core requirements: success stories and models. In: Walter Leal Filho (Ed.), Teaching sustainability at universities. Peter Lang, New York.

UNCED (1992). Promoting education, public awareness and training, Agenda 21, Chapter 36, UNCED, UNESCO, Paris.

UNESCO (1997). Educating for a sustainable future – a transdisciplinary vision for a concerted action. UNESCO, Paris.

Westera, W and PB Sloep (1998). The Virtual Company: towards a self-directed, competence-based learning environment. Educational Technology 38 (1): 32-38.

Westera, W, PB Sloep and JF Gerrissen (2000). The design of the Virtual Company: synergism of learning and working in a networked environment. Innovations in Education and Training International 37 (1): 24-33.